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THE
DAIRY HERD

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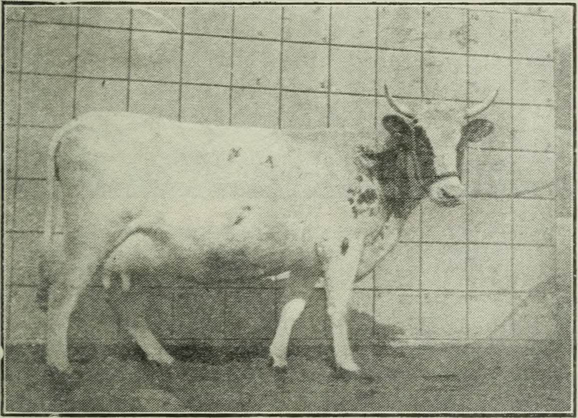
THE DAIRY HERD



AYRSHIRE COW

Reprinted, with adaptations, from "THE DAIRY HERD," *by*
Henry H. Wing, in "Cornell Reading Courses."

THE DAIRY HERD

Henry H. Wing

The products of the dairy cow are fourfold. The first and chief product is naturally the milk which she secretes, and which is used as milk or for butter or cheese making. The second product is the calves which she bears, and which may be of more or less value. Third, the carcass of beef which she will yield when she is no longer useful for the production of milk, should be taken into account. Lastly, the manure she produces is of considerable value.

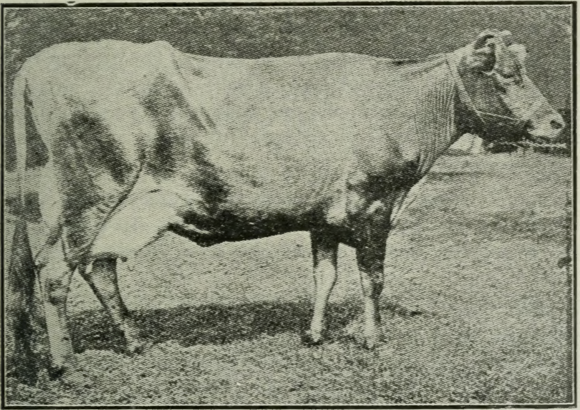


Fig. 16.—*The spare, angular, wedge-shaped form desirable in a dairy cow. The teats are well placed. Compare with Fig.* 17.

The milk may be called the main product, and the calves, the beef, and the manure the by-products, of the dairy cow. It has been asserted that the milk is the only product that should be taken into consideration in estimating the value of a dairy cow, and that the calves and the beef should be entirely ignored by a successful dairyman; but in these days of strong competition it is not possible to ignore the by-products, and in any scheme of successful dairying the calves and the beef must at least be taken into consideration. This does not mean that in any case milk-producing qualities are to be sacrificed for the sake of the by-products. It simply means that of two animals of equal value for the production of milk, the one that will give the greater return in production of calves and value of carcass is the more profitable.

THE SELECTION OF THE HERD

There is no one best breed of dairy cows.—In the formation of a dairy herd one of the first questions to be

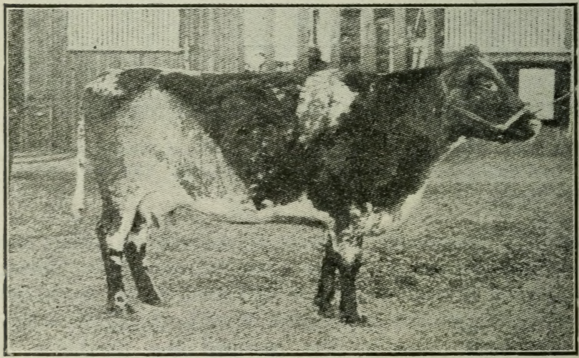


FIG. 17.—*The square, beefy type of cow, usually a poor milker. Note poorly placed teats. Compare with Fig.* 16.

considered is the choice of a breed and whether the herd shall be made up of pure-bred or grade animals. There are several well-known breeds of dairy cattle in Canada, each having distinct qualities and each having strong partisans. While, undoubtedly, some breeds are better fitted for certain conditions of soil and climate than are others, still the matter of the choice of a breed may well be left to individual preference. In almost any location one may choose a breed for which he has a strong liking, either real or fancied, and be assured that he can establish with it a successful herd. Jerseys, Guernseys, Holsteins, Ayrshires, and even Shorthorns, make a varied and fairly long list of breeds from which to select.

The comparative merits of pure-bred and grade cows.—Whether pure-bred or grade animals should be selected is a matter on which there may be more difference of opinion. By purely bred animals are meant those that are recorded in the herd-books of their respective breeds. This is the narrow, restricted sense of the term *pure-bred*, but it is the one in common use in Canada. A grade animal is the produce of a pure-bred sire on a common, or grade, dam. The produce of a pure-bred sire and a common, or "scrub," dam is called a half blood; the produce of a pure-bred sire and a half-blood dam is called a three-quarters blood; a three-quarters blood bred in turn to a pure-bred sire will produce a seven-eighths blood; and so on *ad infinitum*. Since only the offspring of pure-bred parents on both sides are eligible to registry in the herd books of any of the dairy breeds, it follows that, no matter how far the process of grading up by the use of pure-bred sires on grade females is carried, pure-breds, in the technical sense, can never be produced. Since pure-bred animals are sought for breeding purposes, the offspring of pure-bred animals are therefore more valuable and command a higher price than the offspring of grades. Hence, if the value of the calves is taken into consideration, a pure-bred herd is a more productive one, other things being equal, than a grade herd. On the other hand, by the grading-up process referred to, continually selecting the cows that are the best producers, it is entirely possible and by no means difficult to establish a herd of grade cows that will equal in the production of milk any herd of pure-bred animals. Hence, if the main product alone is sought, a grade herd may produce as largely as a pure-bred one ; but if the by-products are to be taken into consideration, as it was stated at the outset that they should be, a pure-bred herd certainly has an advantage over a grade herd of equal productive capacity.

Maintaining the herd.—A dairy herd may be maintained in two ways. First, by continued purchase of mature animals to replace those whose period of usefulness has passed. There are many conditions under which this may be a wise practice. If it is desirable to have the whole herd composed of cows in their full productive capacity, if there is abundant opportunity for selection and purchase near at hand, if there is a reasonably good market for cows that are undesirable, and if one has reasonable skill in selecting and good ability in bargaining—a herd of high productive capacity may be more easily and more cheaply maintained in this way than by attempting to raise young animals to replace those that are worn out.

The other method of maintaining the herd is, of course, by raising calves to supply the place of old cows that are no longer profitable. Such a herd will always contain a considerable number of young animals that have not yet reached full development, and therefore such a herd will seldom equal in average production per animal a herd that is maintained wholly by purchase. At the same time a greater degree of uniformity of type may be maintained where the animals are raised. If land is abundant and cheap, the cost of raising a heifer, up to the time that she becomes a fully developed cow, will be less than that of buying a similar animal outright. Through force of circumstances, by far the greater number of dairymen must rely on raising the calves necessary to maintain the herd. This being the case, the ordinary dairyman will need to provide himself with the services of a bull suitable to produce useful dairy cows. In most cases he will need to own this bull, so that the question of the selection and care of the breeding bull has an important bearing on the maintenance of the dairy herd.

The selection of the breeding bull.—It goes without question that such a bull should be purely bred. There are still far too many immature and ill-bred bulls in use. As a matter of convenience, a yearling bull is turned with the herd about the first of June, and in the course of two or three months when all or nearly all of the cows have become pregnant and he has fattened up, he is sold again at a price little, if any, below his cost, and the dairyman is without the trouble of the care of a bull for several months. If, in addition to this, little attention is paid to the breeding of the bull, it is easily seen that little, if any, improvement in the character of the herd can be expected from his offspring. The progeny that a bull has already produced is by far the best index of his usefulness that a prospective purchaser can have. Cattle do not reach full maturity in either sex, until they are about four or five years old.

Consequently the best bull to select is a bull not less than four years old that has already begot cows of a high productive capacity. Such a bull is, of course, more difficult to control and more expensive to keep, but he is worth many times the trouble and expense as compared with an immature yearling.

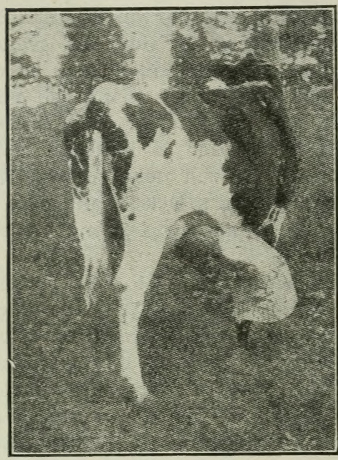


FIG. 18.—*A poorly formed udder, not reaching high up in the rear. Compare with Fig.* 19.

In the selection of a bull, much has been made of various so-called milk signs: rudimentary teats, milk veins, escutcheon, and the like. While each and all of these may be of some value, they are by no means to be set against the record that a bull has made in the production of his daughters. Other characteristics of the bull that indicate vigour of constitution, good digestive organs, and vital activities in general, are a loose, mellow hide, a bold, bright eye, an active gait and disposition. These are of great importance as indicating capacity to reproduce similar characteristics in his offspring.

The management of a breeding bull.—The management of a bull on a dairy farm is often a matter of a good deal of trouble and perplexity. In a herd of ordinary size a single bull is sufficient, and it is usually necessary that he be kept from the herd during the greater part of the year. This means that he must be kept in solitary confinement. The result of this is, too often, that his temper becomes uncertain and his breeding powers impaired from lack of exercise. In all cases where

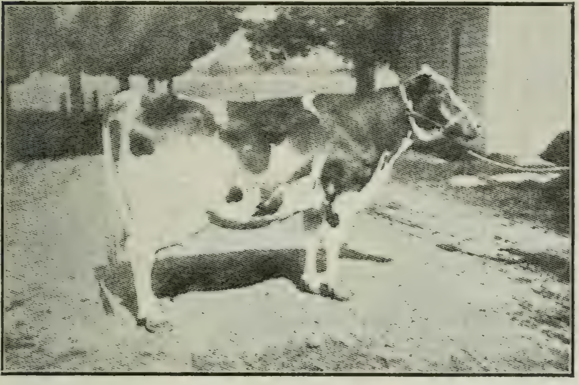


FIG. 19.—*A well-formed udder, reaching high up. Compare with Fig.* 18.

it is possible to do so, it is better that the bull should run with the herd of cows. With a little care this can frequently be done, particularly during the summer and fall, when the cows are all pregnant in a spring calving herd, and in the spring and early summer, when the cows are all pregnant in a fall calving herd.

The powers and the temper of a bull may also be safeguarded by giving him exercise on a tread power, or hitched by a long rope or chain to a wire between two upright posts, or attached to a pole balanced on a post so that he may move around it. Occasionally, also, the labour of a bull may be utilized on a tread power for cutting feed, pumping water, or separating milk. Sometimes a particularly handy owner will break a bull to work to harness or in a cart. It may even be time and labour well spent to give a bull walking exercise. A good, vigorous animal, carefully kept, should retain his breeding powers up to eight or nine years of age, or even beyond.

Weeding out the scrubs.—According to the census of 1910 the production of the 1,509,594 cows in New York State amounted to 6,657,309,540 pounds of milk,

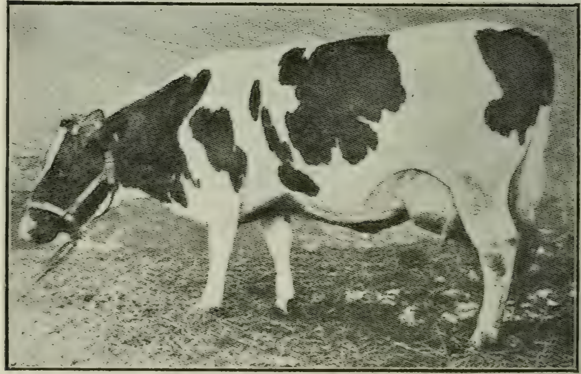


FIG. 20.—*The prominent milk veins of this cow would lead one to believe her to be of a good dairy type, if there were no better way of judging her.*

or 4,410 pounds per cow. This indicates that the average cow of the State of New York is of little or no profit to her owner.

In order to determine whether or not the average cow is profitable to her owner, it is necessary to make a calculation of the value of her product and the cost of maintenance for a year. Lacking accurate data for a large number of individuals, such a calculation must be largely in the nature of an estimate, and it is governed to a considerable extent by local market fluctuations in prices of feed and dairy products. The following is therefore given only as an estimate, to be varied in any respect as particular conditions seem to warrant. In other words, it merely gives a basis for any estimate that an individual dairyman may see fit to make in regard to his own herd.

VALUE OF PRODUCTS FROM THE AVERAGE DAIRY COW IN NEW YORK STATE

4,410 lbs. milk at $1.50 per 100 lbs.	$66.15
4,410 lbs. milk (3.8 per cent. fat plus $\frac{1}{6}$) =195.5 lbs. butter, at 35 cents	68.43
4,410 lbs. milk (9 lbs. milk for 1 lb. cheese) = 490 lbs. cheese, at 13 cents	63.70
Average	$66.09

COST OF FOOD AND MAINTENANCE

26 weeks' pasture at 30 cents	$7.80
40 lbs. silage per day for 180 days at $3.50 per ton	12.60
10 lbs. hay per day for 180 days at $12 per ton	10.80
1,470 lbs. grain at $30 per ton	22.05
(1 lb. of grain for each 3 lbs. of milk, or 7 lbs. per day for 7 months)	
Cost of food	$53.25

Depreciation, $25 in five years, per year	$5.00
Interest on investment, $60 per cow at 6 per cent	3.60
Balance available to pay for labour	4.24
Total	$66·09

From this estimate it appears that the owner of the average dairy cow will have about $4.25 to pay for labour. Whether or not this is a sufficient amount, each owner must determine for himself. On the basis that it would require the entire labour of one man to feed, care for, and milk twenty cows, it would mean a labour return of only $85 for the year, which is far below the lowest wage paid to ordinary farm labour.

It will be observed that the above figures refer to New York conditions and pre-war figures. The conditions revealed, however, are approximately the same as found in Ontario and Eastern Ontario, and practically the same results would have been secured if Canadian figures could have been used. The illustration shows the principles involved in finding the returns from dairy cows no matter where they are found—the figures and prices would have to be changed according to local markets.

The first problem, then, of the successful dairyman is to separate the poor cows from the good ones. There is no means of determining the difference between a good and a poor cow except by keeping a record of her production. The knowledge of what a cow has already produced is of far greater usefulness as indicating what she is likely to produce in the future than any correspondence of her outward form with any standard, no matter how carefully the standard is devised or how skilfully she is judged by it. The successful dairyman, then, keeps careful records of the production of his cows and bases his selection on them. Since fat is by far the most valuable constituent of milk, the usefulness of a cow is largely indicated by the number of pounds of fat that she produces in any given period of time. The number of pounds of fat that a cow produces is readily determined by knowing the number of pounds of milk and the percentage of fat that it contains.

In order to obtain a complete record of a cow, it is necessary that the milk be weighed and the fat determined at regular intervals. In determining the production of a cow the record may be complete or incomplete. A complete record requires a greater expenditure of time, labour, and care, but it gives an absolute record of the production. An incomplete record, requiring considerably less time, labour, and care, may enable one to make an estimate of the production that will be nearly or quite as valuable as an absolute record. The most perfect record is made by weighing and recording each milking, taking at the same time a small sample which is kept in a common receptacle during the period of a week, after which the fat is determined by the Babcock method. If this is too much trouble, the milk may be weighed at each milking and the fat determined in the milk of a single day at intervals of a month. This method has been shown to give results that are sufficiently accurate for all practical purposes.

Judging a dairy cow.—The regular use of the milk scales and the Babcock test is an indispensable part of the labour of the modern, progressive, successful dairyman. Still there are many occasions when it is desirable or necessary to form some estimate of the qualities of a cow where the information given by the scales and the Babcock test is lacking. There are certain characteristics of form that more or less certainly indicate the capacity of a dairy cow. Many become so skilful in recognizing these characteristics that they are able to separate good from poor cows to a highly useful degree. A knowledge of these characteristics is indispensable to a skilful dairyman.

It is generally recognized that a cow should be wedge-shaped, that is, the skeleton of the hinder portions of the body should be distinctly more largely developed than that of the forward portions. She would stand from half an inch to an inch and a half higher at the hips than at the shoulders. The width, as viewed from the front, should be distinctly wider behind than before, and the depth of the body as viewed from the side should be distinctly greater behind than before.

In order to produce large quantities of milk the dairy cow must also have vigorous powers of respiration and circulation. Since milk is formed from the blood, vigorous circulation is required to carry the blood in large quantities to the udder, and particularly to the minute capillaries. Vigorous powers of respiration are necessary to purify the large quantities of blood which must pass through the lungs. Vigour of respiration is indicated by a large, deep, full chest, particularly wide on the floor ; and by large, clean, open air passages, particularly the nostrils and the throat. Vigour of circulation is indicated by prominent exterior blood-vessels and by bright, pink complexion of the thinner portions of the skin and visible mucous membranes.

In order to secrete large amounts of milk, a cow must digest and assimilate large quantities of food. She must therefore have large powers of digestion, assimilation and secretion. Capacity to digest is indicated to a certain extent by the size of the digestive organs, since a large part of the cow's food is bulky, and she must have capacity to take in large amounts of food in a short time. Vigour of assimilation and secretion is seen in the abundance and healthy condition of the hair, and in the softness and pliability of the skin and the abundance of secretion from it.

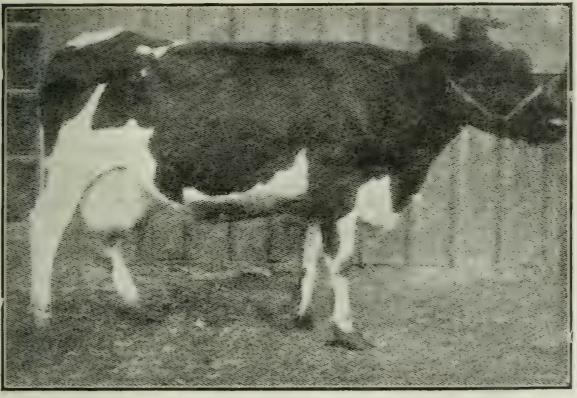


FIG. 21.—*An excellent three-quarters bred cow, showing what a pure bred sire can do in two generations. The grandmother of this cow was a rather poor milker. She herself produced in nine years, beginning when she was two years old,* 96,800 *lbs. of milk and* 3,814 *lbs. of butter.*

Good points in the udder.—More useful than any other outward characteristics of the cow, as indicating her capacity to secrete, is the size and condition of the udder. Naturally, a useful cow must have a large udder, and, from the æsthetic point of view, the more regular in form it is, the better. The actual size and capacity of the udder, however, may not be indicated by its apparent size. In some animals the udder is held so close to the walls of the abdomen, and so great a part of it is hidden between the legs, that it may appear smaller than a more pendulous udder of the same size, or even smaller. So, too, in judging of the quality of an udder, its so-called fleshiness must be taken into consideration ; that is, in some udders the connective and fatty tissue is so much more abundant that it occupies room that would otherwise be occupied by true milk-secreting follicles. Such an udder will be tense and firm, especially when empty, and will have little secreting capacity in comparison with its size. A so-called fleshy udder is approximately of the same size when empty as when full. An udder in which the greater part of the tissue is made up of milk ducts and secreting follicles will shrink rapidly as the milk is drawn from it, and when empty will be particularly loose, pliable and flexible.

Popular milk signs.—In the cow, as in the bull, there is a considerable number of so-called " milk signs " that are relied on more or less implicitly by various people in judging or selecting cows. Foremost among these are the so-called milk veins. These milk veins never by any possibility contain milk, but form a system of exterior veins on the lower part of the abdomen that serves to convey a part of the blood from the udder back toward the heart. They vary in size, in length, in sinuousness and in simplicity or multiplicity of branches. Inasmuch as their size indicates, to a certain extent, the amount of blood circulating in them, they may be considered as useful signs. The larger the veins, naturally, the larger the amount of blood flowing through them. A cow with a large, elastic, tortuous and branching milk vein is likely to be a better cow than one less well developed in this respect. However, the milk veins cannot be relied on implicitly as indicating the capacity of an animal to produce milk.

The milk veins usually enter the abdomen by one or more distinct perforations on each side, called milk wells or holes. A large perforation offers less obstruction to the vein, and so impedes the circulation less—and to that extent is a useful sign ; but to judge between the merits of two cows merely on differences in the size of milk wells is to carry the matter much too far.

It is now scarcely necessary to more than mention the milk mirror, or escutcheon, as the area of up-growing hair on the rear of the udder, thighs and perineum is called. Variations in the size and shape of this area were seized on by the French writer Guenon as indicating the amount and duration of milk secretion. On these variations he constructed an elaborate table, showing the amount of milk that a cow possessing an escutcheon of a certain size and shape would give. Guenon had a large following for many years in this country, but at the present time scarcely any attention is given to the escutcheon.

It has been observed that an animal in which the joints of the skeleton are not too closely knit is likely to have good powers of assimilation. This has been seized on by those who consider what is known as the "open organization," as indicating great capacity to secrete. This loose-jointedness, or open organization, is well indicated by the distance between the vertebræ in the spinal column, so that the open, or loose, chine is taken to indicate good capacity to secrete. Doubtless it is of more or less value, but there are many animals that are highly satisfactory as producers that are not at all remarkable for looseness of chine, or open organization.

The size of the umbilicus is also taken as an indication of the capacity of the animal to give milk. The argument of some is that a large umbilicus indicates that the umbilical cord in the fœtus was large and the fœtal circulation strong; and that such an animal, being strongly nourished in the womb by its mother, has thereby a stronger constitution than one with a small umbilicus. Careful observation has shown, however, that the size of the umbilicus is more of a breed than an individual characteristic.

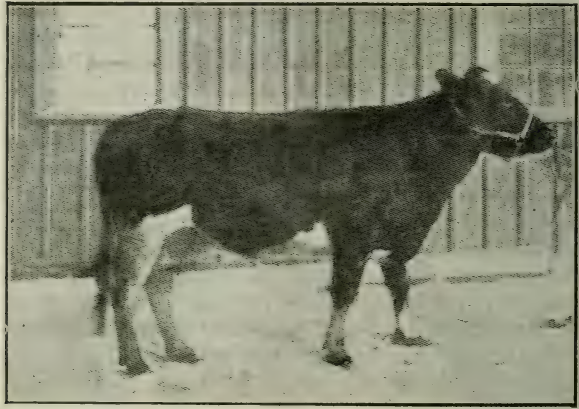


FIG. 22.—*The beefy type of cow, usually unprofitable in the dairy. She uses too much feed for laying on flesh, and too little for making milk. Compare with Fig.* 21.

There is a cord or fibrous band in the flank that varies in prominence and rigidity in different individuals. A strong, prominent band is taken as an indication of good powers of secretion. On the front part of the bone of the tibia, just below the stifle joint, there may be detected a depression that varies in size in different individuals. A large depression at this place is supposed to indicate great powers of secretion. Its value, however, has never been conclusively proved.

Standards in judging dairy cows.—In order that a cow may be carefully examined in respect to the various characteristics just discussed, various standards or scales of points are in use, particularly by students in the agricultural colleges. The application of such a scale of points to any individual is called scoring, and skill in making judgment is attained only by carefully scoring a considerable number of animals. Such scales, or standards, while they correspond in the main features, differ more or less in minor details, according to the judgment of those who formulate them. Such a standard is given on page 20 as a sample of those in ordinary use.

GRADING UP THE HERD

The successful and progressive dairyman will not only give his best efforts toward obtaining a herd that will make a satisfactory production, but will look to the future and bring about still further improvement by breeding from his herd succeeding generations that shall be even larger producers than their ancestors. Such a dairyman may, if he chooses, obtain as the foundation herd pure-bred animals that may be depended on to transmit their qualities to their descendants. But with even the highest-bred animals there will be the necessity for selection if the original standards of production are to be maintained, to say nothing of being increased. On

Cornell University
COLLEGE OF AGRICULTURE
SCORE CARD
Dairy Cattle

Scale of Points		Points deficient	
	Perfect score.	Student's estimate.	Corrected.
GENERAL APPEARANCE—			
Weight, estimated..........pounds; actual..........		.....	.....
Form wedge-shaped as viewed from front, side, and top..........	5	.....	.....
Form spare, as indicated by prominent joints and clean bone, and lack of muscular development along ribs and loins..........	8	.....	.....
Quality, hair fine, soft; skin pliable, loose, medium thickness; secretion yellow, abundant..........	8	.....	.....
Constitution vigorous, as indicated by alert expression, evidently active vital functions, and general healthy appearance..........	6	.....	.....
HEAD AND NECK—			
Muzzle clean cut; mouth large; nostrils large....	6	.....	.....
Eyes large, bright..........			
Face lean, long; quiet expression..........			
Forehead broad, slightly dished..........			
Ears medium size; fine texture..........			
Neck fine, medium length; throat clean; light dewlap..........			
FORE AND HIND QUARTERS—			
Withers lean, thin; **Shoulders** angular, not fleshy...	3	.....	.....
Hips far apart; not lower than spine..........	5	.....	.....
Rump long, wide, comparatively level..........			
Thurls or Pin Bones high, wide apart..........			
Thighs thin, long..........	2	.....	.....
Legs straight, short; shank fine..........	1	.....	.....
BODY—			
Chest deep; with large girth and broad on floor of chest; well-sprung ribs..........	10	.....	.....
Abdomen large, deep; indicative of capacity; well supported..........	4	.....	.....
Back lean, straight; chine open. **Tail** long, slim, with fine switch..........	4	.....	.....
Loin broad..........	2	.....	.....
MILK-SECRETING ORGANS—			
Udder large, long, attached high and full behind, extending far in front and full; quarters even....	20	.....	.....
Udder capacious, flexible, with loose, pliable skin covered with short, fine hair..........	10	.....	.....
Teats convenient size, evenly placed..........	2	.....	.....
Milk veins large, tortuous, long, branching, with large milk wells. **Escutcheon** spreading over thighs, extending high and wide..........	4	.....	.....
Total..........	100	.....	.....

Animal..........................**Date**..........................
Student..........................**Total score**..........................

the other hand, the large majority of dairymen seeking to improve their herds must depend more or less upon the individual animals they have already on hand as the basis from which to start the improvement. In either case, careful selection must be practised, and a knowledge of at least the elementary principles of selection is necessary for progress along this line. It is proposed, then, briefly to indicate the lines along which an attempt to breed up or improve a herd of common native or mixed cattle is most likely to prove successful.

The first step in such improvement is in the selection of a suitable bull. Such a bull, besides being a well-developed individual with strong constitutional and vital powers, must be purely bred in order that he may have sufficient prepotency to transmit his characteristics to his offspring, no matter what may be the qualities of the females with which he is mated. He is likely to be found in a herd all the members of which are uniform in productive capacity and have been bred under the same conditions for a number of generations. A bull useful as a prepotent animal to mate with common or mixed females is quite as likely to be the son of parents of something more than average merit as the offspring of what some are pleased to call "phenomenal" animals.

Select calves that show the good qualities of the bull.—In the improvement of a herd of cows it has been very common to recommend that the practice should be to use a pure-bred bull and to raise the heifer calves from the best cows in the herd. Whether or not this practice is correct will depend, to a great extent, on what is meant by the term "best cows." If it means merely that the heifer calves from the common cows that are the highest producers are to be raised, it cannot be accepted without qualification. The first and great step in improvement under such a course of breeding comes from the prepotent qualities of the bull. Logically, therefore, the best calves to raise are those in which the prepotent qualities of the male are most clearly shown at time of birth, such as in colour markings or similar characteristics. These may or may not be the offspring of the highest-producing cows. Often the foundation herd of cows is admittedly inferior, even the best of them. If the proper judgment in selecting the bull has been exercised, there is in him greater chance for improvement than in any of the cows, even the best. It would therefore seem to be good logic and safe practice to disregard the qualities of the cow entirely in the first generation and depend on the prepotency of the bull.

A great advantage in the rapid improvement of a herd of cows under this grading-up process is the ability to raise a large number of individuals up to the time they begin to produce, so that a greater number may be available from which to select. In the first generation, therefore, it is a great advantage to be able to raise all of the half-blood heifer calves that are born strong and with good vital powers, irrespective of the qualities of their dams. In many cases, however, the circumstances of the owner do not admit of rearing so large a number, and some selection must be made at the time of birth. If it is conceded that it is not an entirely safe practice to base this selection on the producing capacity of the dams, some other basis of selection must be looked for.

Breed from cows that show variation, particularly toward improvement.—It is a generally accepted principle of heredity that an animal which shows a tendency toward variation is one that is not likely to be prepotent.

Calves should be raised from cows that are not prepotent in order that the prepotent qualities of the bull may have full scope. Cows, then, that show tendency toward variation, particularly toward improvement, are logically the ones over which the male is most likely to be prepotent and at the same time the calves show the greatest tendency toward improvement. It is comparatively easy to determine in any herd of cows those which show the greatest tendency toward variation, and more

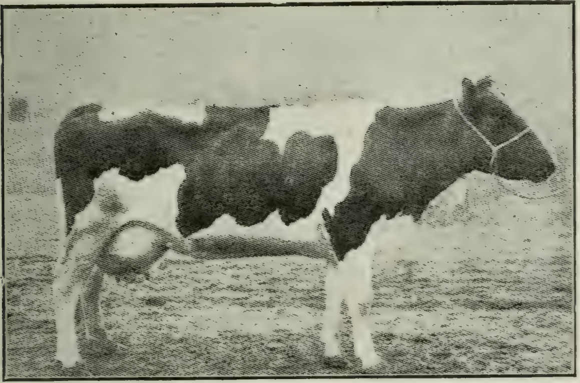


Fig. 23—*Prominent veins on the udder are thought to be an indication of good milking qualities.*

particularly those which show the greatest tendency toward improvement when their conditions are made more favourable. It can be determined then the cows from which it is likely to get the best half-blood heifer calves by giving the herd more and better feed and selecting calves from those animals which show the greatest improvement under such a change of treatment.

In actual practice it will be found that the animals that show the greatest increase in production under more liberal feed are not necessarily those that were either the largest or the smallest producers under scant rations. This is shown in the following actual occurrence. A record was obtained of the yearly production, in pounds of butter-fat, of a herd of nine cows that had been kept for a considerable period of time under scant rations. The succeeding year these cows were fed liberally—"liberal" in this case meaning practically all the food they would eat regularly—and a record of production was kept as before. The results are seen in the following table, the cows being arranged in the order of their greatest production the first year :—

Cow		Pounds of butter-fat produced under scant feeding	Pounds of butter-fat produced under liberal feeding	Percentage of gain or loss	
No. 1	..	177	303	gain	71
No. 2	..	174	258	gain	48
No. 3	..	172	314	gain	83
No. 4	..	169	108	loss	36
No. 5	..	157	276	gain	76
No. 6	..	154	274	gain	78
No. 7	..	132	148	gain	12
No. 8	..	129	267	gain	107
No. 9	..	125	232	gain	86

Now suppose that these cows the second year had all been bred to a pure-bred bull and that they all dropped heifer calves, but that it was possible for the owner to raise only four calves of the nine. If he had based his selection on those that were the highest producers, he would have raised the calves from Nos. 1, 3, 5, and 6. If, however, he had based his selection on those that showed the greatest capacity to improve under more liberal treatment, he would have raised the calves from Nos. 8, 9, 3, and 6. It is for each one to determine for himself which is the more logical practice.

Experience has shown that where the principles stated have been carefully carried out a very satisfactory improvement has been obtained in the first generation. It is not uncommon to find an increase of fully fifty per cent. in the average production of half-blood cows over their common mothers. Experience has also shown that in the second generation the three-quarters bloods are not nearly so uniform as the half bloods and frequently show little, if any, increase in average production, though a few individuals will show a marked improvement. The question then comes as to how to obtain a greater uniformity and a higher average production in the second generation, or the three-quarters bloods.

Breeding the second generation.—If the selection of the original pure-bred bull has been a wise one and if he was a young animal at the time of his purchase, there will be a considerable number of his half-blood offspring ready to be bred while he is still in the zenith of his powers. Most breeders hesitate to breed such an animal to his own offspring, and it is seldom recommended. But if inbreeding is ever likely to be followed with useful results, it will be under just such conditions; and in proportion as both the bull and the half-blood heifers show strong individual vital powers, the practice is to be recommended. In a majority of cases, the very best bull to breed to a lot of high-quality, uniform, half-blood heifers is their own sire, if it is desired to obtain greater uniformity and greater average production in their offspring. The reason for the lack of uniformity in the three-quarters-bred offspring is the fact that reversions occur to the qualities of their common and mixed grandmothers. It will require, then, even stronger prepotency to overcome this tendency to reversion, and the animal that is most likely to be prepotent over such half-bloods is their own sire.

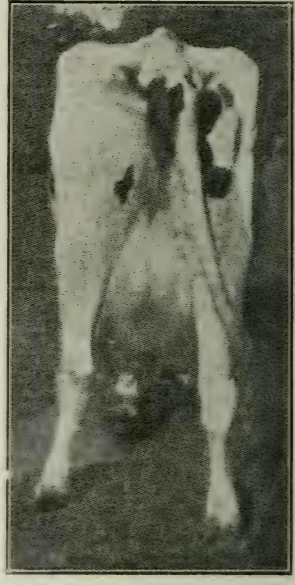


FIG. 24.—*Good hind quarters and a perfect udder. Compare with Figs.* 18 *and* 19.

Continued judicious selection the means of improvement.—It must be remembered that the improved production in the first place was obtained by improving the conditions of environment, which, so far as the ordinary dairy herd is concerned, means simply more food; and that it was perpetuated in the case of pure-bred animals by selection. Having obtained improvement now by the use of a pure-bred male on common or mixed females, it is, of course, necessary that it shall be maintained by liberal care and feeding. A pure-bred animal can transmit only its inherited tendencies, and if these inherited tendencies are not backed up by abundant and nutritious food the improvement obtained is sure to be lost. Having now obtained a marked improvement in two or three generations by the use of a pure-bred male on common or mixed females, with intelligent selection and intelligent inbreeding, the further course of improvement is the maintenance of proper conditions of environment and careful selection. As generations come on, characteristics of the original pure-bred sire will become more and more fixed and uniform, reversions will be less and less frequent, and the herd will be purely bred from the standpoint of the capacity of individual members to produce their characteristics, though they never become eligible to registration in a herd book. This is a course that has been successfully practised in the improvement of a large number

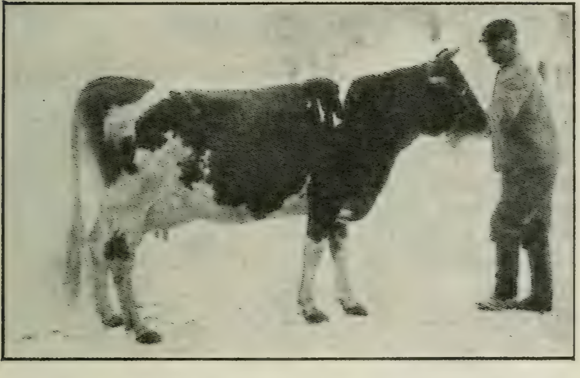


FIG. 25.—*An ideal type in a young dairy cow. Note the fine head, horns and legs, the well developed chest, the strong hind quarters, and the large, well shaped udder.*

of herds of dairy animals, and is entirely within the reach of any one of ordinary skill and intelligence.

A specific case in grading up a herd.—As an illustration of this practice there is shown the improvement that was obtained in the case of the descendants bred from a single animal according to these principles.

The table shows the improvement in the descendants of an inferior cow by pure-bred bulls. Underneath each individual is given the number of years she was in the herd and her average yearly production in pounds of fat. Those indicated by a star are in the herd at the present time.

While the practice outlined has been particularly applied to the development and improvement of a herd starting with inferior or common cows as a basis, it should be remembered that the same principles apply equally well to any herd. There are very few herds, even the best of purely bred animals, in which the intelligent application of these principles would not result in marked improvement.

Gl. Fatinitza......... **Gl. Gwyn**
1 Yr. Av. 281 lbs. 1 Yr. Av.
291 lbs.

...
lbs.

Gl. Galatea
2 Yrs. Av.
330 lbs.

Gl. Francesca........
3 Yrs. Av. 322 lbs.

***Gl. Godiva**
2 Yrs. Av.
270 lbs.

lbs.

...
lbs.

***Fenella**
4 Yrs. Av. 405 lbs.

lbs.

lbs.

- Glista 3 Yrs. Av. 188 lbs.
  - **Glista 2nd** 1 Yr. Av. 188 lbs.
    - **Gl.Netherland** 5 Yrs. Av. 286 lbs.
      - **Gl. DeKol** 6 Yrs. Av. 303 lbs.
        - **Gl. Gamma** 8 Yrs. Av. 336 lbs.
          - **Gl. Mu** 6 Yrs. Av. 285 lbs.
            - **Gl. Fatinitza** 1 Yr. Av. 281 lbs.
              - **Gl. Gwyn** 1 Yr. Av. 291 lbs.
            - **Gl. Francesca** 3 Yrs. Av. 322 lbs.
              - **Gl. Galatea** 2 Yrs. Av. 330 lbs.
              - ***Gl. Godiva** 2 Yrs. Av. 270 lbs.
          - ***Gl. Esmeralda** 4 Yrs. Av. 298 lbs
        - **Gl. Iota** 7 Yrs. Av. 381 lbs.
          - ***Gl. Ernestine** 6 Yrs. Av. 443 lbs.
            - ***Fenella** 4 Yrs. Av. 405 lbs.
        - ***Gl. Omicron** 10 Yrs. Av. 360 lbs.
          - ***Gl. Eglantine** 6 Yrs. Av. 345 lbs.
          - ***Gl. Eudora** 4 Yrs. Av. 326 lbs.
        - **Gl. Tau** 5 Yrs. Av. 255 lbs.
          - **Gl. Eloise** 2 Yrs. Av. 283 lbs.
          - **Gl. Eleanor** 1 Yr Av. 286 lbs.
      - **Gl. Alpha** 10 Yrs. Av. 294 lbs.
        - **Gl. Pi** 2 Yrs. Av. 198 lbs.
          - **Gl. Omega** 3 Yrs. Av. 309 lbs.
            - **Gl. Flora** 3 Yrs. Av. 274 lbs.
        - **Gl. Phi** 1 Yr. Av. 231 lbs.
          - ***Gl. Echo** 6 Yrs. Av. 375 lbs.
            - ***Gl. Fantasy** 2 Yrs. Av. 198 lbs.
          - **Gl. Ebony** 1 Yr. Av. 304 lbs.
        - **Gl. Alpha 2nd** 1 Yr. Av. 204 lbs.
      - **Gl. Epsilon** 9 Yrs. Av. 312 lbs.
        - **Gl. Nu** 5 Yrs. Av. 317 lbs.
          - **Gl. Eva** 4 Yrs. Av. 270 lbs.
            - ***Gl. Fancy** 2 Yrs. Av. 209 lbs.
        - **Gl. Upsilon** 3 Yrs. Av. 163 lbs.
  - **Glista 3rd** 2 Yrs. Av. 252 lbs.
  - **Glista 4th** 8 Yrs. Av. 274 lbs.
    - **Gl. Beta** 10 Yrs. Av. 309 lbs.
      - **Gl. Lambda** 4 Yrs. Av. 292 lbs.
        - **Gl. Chi** 4 Yrs. Av. 281 lbs.
          - ***Gl. Elora** 5 Yrs. Av. 338 lbs.
      - **Gl. Carlotta** 3 Yrs. Av. 299 lbs.
        - **Gl. Dora** 1 Yr. Av. 239 lbs.
          - **Gl. Elaine** 2 Yrs. Av. 370 lbs.
      - ***Gl. Cora** 5 Yrs. Av. 433 lbs.
      - ***Gl. Coreva** 5 Yrs. Av. 314 lbs.
        - ***Gl. Dinah** 2 Yrs. Av. 294 lbs.
    - **Gl. Delta** 9 Yrs. Av. 348 lbs.
    - **Gl. Theta** 7 Yrs. Av. 302 lbs.
      - **Gl. Rho** 4 Yrs. Av. 301 lbs.
      - **Gl. Psi** 8 Yrs. Av. 325 lbs.
        - **Gl. Duchess** 1 Yr. Av. 220 lbs.
      - **Gl. Candida** 5 Yrs. Av. 273 lbs.
    - **Gl. Eta** 10 Yrs. Av. 327 lbs.
      - **Gl. Coriander** 1 Yr. Av. 233 lbs.
        - ***Gl. Dorothea** 4 Yrs. Av. 301 lbs.
        - ***Gl. Draba** 5 Yrs. Av. 401 lbs.
          - **Gl. Erato** 1 Yr. Av. 246 lbs.
      - **Gl. Corinne** 3 Yrs. Av. 253 lbs.
        - **Gl. Dewdrop** 3 Yrs. Av. 256 lbs.
          - ***Gl. Eli** 2 Yrs. Av. 296 lbs.
      - **Gl. Xi** 1 Yr. Av. 180 lbs.
      - **Gl. Sigma** 5 Yrs. Av. 341 lbs.

Average by generations.							
188 lbs.	238 lbs.	314 lbs.	296 lbs.	277 lbs.	318 lbs.	281 lbs.	297 lbs

ADVANCED READING ON SUBJECTS CONNECTED WITH DAIRY FARMING.

General.

Eckles, C. H. Dairy cattle and milk production. The Macmillan Company, New York.
Wing, H. H. Milk and its products. The Macmillan Company, New York.
Harper, M. W. Manual of farm animals. The Macmillan Company, New York.
Lane, C. B. Business of dairying. Orange Judd Company, New York.
Plumb, C. S. Types and breeds of farm animals. Ginn & Company, Boston, Massachusetts.
Winslow, K. Production and handling of clean milk. W. R. Jennings Company, New York.
Eckles, C. H., and Warren, G.F. Dairy farming. The Macmillan Company, New York.
Dean, H. H. Canadian dairying.
Rose, Laura. Farm dairying.

Structures.

King, F. H. Physics of agriculture. F. H. King, Madison, Wisconsin.
King, F. H. Ventilation. F. H. King, Madison, Wisconsin.
Farm buildings. Sanders Publishing Company, Chicago, Illinois.
Shawver, J. L. Plank frame barn construction. David Williams, 232, William Street, New York.
King, M. L. Silos—Construction and service. Webb Publishing Company, St. Paul, Minnesota.

Feeding.

Henry, W. A., and Morrison, F. B. Feeds and feeding. The Henry-Morrison Company, Madison, Wisconsin.
Jordan, W. H. Feeding of animals. The Macmillan Company, New York.
Smith, H. R. Profitable stock-feeding. H. R. Smith, St. Anthony Park, Minnesota.

Breeding.

Davenport, E. Domesticated animals and plants. Ginn & Company Boston, Massachusetts.
Davenport, E. Principles of breeding. Ginn & Company, Boston, Massachusetts.
Harper, M. W. Breeding of farm animals. Orange Judd Company, New York.

Diseases.

Law, J. The farmers' veterinary adviser. W. R. Jenkins Company New York.
Mayo, N. S. Diseases of animals. The Macmillan Company, New York.
* Diseases of cattle. U.S. Agr. Dept., Bureau of Animal Industry, Washington, D. C.
* Diseases of the horse. (Same as above.)

Judging.

Gay, Carl W. Principles and practice of judging live stock. The Macmillan Company, New York.
Plumb, C. S. Judging farm animals. Orange Judd Company, New York.
Craig. Judging live stock.

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*May be bought from the Superintendent of Documents Washington, D. C.

THE DAIRY HERD

DISCUSSION PAPER.

The Discussion Paper is planned to help the student by drawing his attention to the important points of the subject he is studying. It is intended to develop thought and self-expression of his own ideas. Each Discussion Paper, when answered and returned, is carefully read by the staff of the Department of Agriculture, and a personal statement is given in connection with any question that the reader thinks the student has not fully understood. The student is invited to ask any questions that will help to give him a more complete understanding of the Course.

GENERAL INSTRUCTIONS.

1. Always express your ideas in your own words.
2. Finish one paper at a time.
3. See that the subject is placed at the top of the first page of each paper answered.
4. Do not forget to write your NAME, NUMBER, and COMPLETE ADDRESS, on each set of answers.
5. Number each question, and also each sheet, and pin them together in their right order.
6. Send in each paper as soon as completed.

QUESTIONS.

1. Name, and discuss briefly, the relative value of the four products of the dairy cow.

2. There is a saying: "The bull constitutes one half of the herd." What is your opinion as to the truth of the saying ? Give a few reasons for your opinion.

3. In selecting a bull as a sire what information would you seek to secure about him ?

4. In starting in to improve your herd's milk production what is the first step you would take ? Describe in detail as far as possible.

5. Describe the ideal udder in a dairy cow.

6. What characteristics are indicated in a dairy cow by the following :—
    (*a*) Wedge-shaped form.
    (*b*) Openness in vertebræ, ribs, and chine.
    (*c*) Large bright eyes—quiet expression, fine neck, clean throat.
    (*d*) Deep, broad chest with well-sprung ribs.
    (*e*) Large barrel or abdomen with well-sprung ribs—well supported.

7. How would you select from among your home-bred calves those that you wished to rear for your own future milking herd ?

8. What is the reason for lack of uniformity in the three-quarters-bred offspring.

9. If you were about to start up a dairy herd what breed of cattle would you select ? Give your reasons for your answer.

10. What indications would you look for in order to estimate the condition and health of a dairy cow ?

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